

# Making Common Understanding Common

## Using Clear, Task-Adequate Specifications

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# Task-adequate Reqts.

- ◆ **Task-adequate** means that consuming stakeholders (estimators, architects, developers, testers) are able to use the requirements information to perform their assigned tasks **without having to cope with defects** (imprecision, incompleteness, or inconsistency) in the information.
- ◆ **Task-inadequate** requirements lead to **uncoordinated coping behavior** by consuming stakeholders and **inevitable misunderstandings**.

# Sooner or Later

Precision *always* happens  
(code & tests)

The issue is not **if** but  
**when** it first appears,  
**who** provides it, and  
**when** it can be validated

# Goals of Detailing

To provide “just enough” details in “just the right” places to **minimize the risk of critical misunderstandings**

i.e., good specs require good judgment

The Pareto Principle applied to requirements: 80% of the misunderstandings are caused by 20% of the requirements

The **value** of precise specification is ***directly*** proportional to its difficulty i.e., not pain, no gain.

# Palette of 18 Specification Patterns



## A. Overview

1. Background
2. Features

## B. Usage Models

1. User Stories
2. Precise Use Cases
3. Precise Scenarios
4. Acceptance Test Specs

## C. Behavior Models

1. Decision Tables
2. State Transition Tables

## D. Facts

1. Constant Conditions
2. Condition Dependencies

## E. Derivations

1. **Derived Values**
2. **Derived Conditions**
3. Derived Actions

## F. Definitions

1. *Entity Specs*
2. **Action Contracts**
3. **Quality Specs**
4. Common Descriptions
5. Acronyms

# E1. Derived Values

*Unconditional* derivations

- formula
- data set (aggregate) function

*Conditional* derivations

- value/formula logic table

**Weekly income** =  
yearly income / 52

**After sale days** =  
*current date* – sale date

**Total of orders for**  
***salesperson-id* in *year-id*** =  
SUM OF values  
FROM orders  
WHERE  
(sales contact = *salesperson-id*)  
AND (year = *year-id*)

# Value Logic Table

state	city	tax-rate
AZ		.025
MN	Edina	.038

**Sales-tax-rate for**

*city-id* in *state-id* = tax-rate

FROM sales-tax-rate-table

WHERE

(*state* = *state-id*)

AND (*city* = *city-id* OR blank)

Derived values may appear in  
output entity values, derived conditions,  
action contracts, and other derived values

## E2. Derived Conditions

**Derived conditions** name collections of logical expressions joined by *ANDs* and *ORs*

**potential customer** =

*bought-many-services or  
bought-services-A-and-B or  
bought-a-lot-of-service-C*

**bought-many-services** =

*total-invoiced-service-types > 5*

**bought-services-A-and-B** =

*invoiced-for-service-A  
and invoiced-for-service-B*

**bought-a-lot-of-service-C** =

*invoiced-amount-for-service-C  
> \$500,000.00*



# Trigger Events

Derived conditions can also define trigger events:

*platform failure =*  
*power failure*  
*or hardware failure*  
*or communication failure*  
*or system software failure*

*water too high =*  
**level above 100 meters**  
**for 4 seconds**

# Derived Condition Table

<i>subject</i>	<i>predicate set</i>	1	2	3	4
PO age	integer ranges	$\geq 25$	$< 25$ $\geq 21$	24 or 23	$< 24$
PO sex	[M, F]	-	M	M	F
PO marital status	[M, S]	-	M	S	-
Annual business distance	integer ranges	$> 4800$ km	-	-	-
Operator class		07	09	13	13

PO = primary operator of a vehicle

# What Does This Mean?

A data mining requirement:

**Accurately identify  
potential customers**

# F1. Entity Specs

- ◆ Internal entities
  - ◆ domain  
e.g., order, customer
  - ◆ system  
e.g., user
- ◆ Input entities  
e.g., reservation locator
- ◆ Output entities  
e.g., logs, messages, reports

# Internal Entity – System Reqt.

## System Requirement attributes

Identifier & Name

Description

Domain & Subdomain (e.g., quality:  
performance)

Prerequisite & Corequisite requirements

Groups (i.e., key words)

Sources (stakeholder name & role, reference  
system, organizational tasks &  
procedures, standard or guideline,  
legal reference, parental requirements)

Application priority (need, want, preference)

Security level

Assumptions & Reasons

Parts of the verification strategy  
(analysis, review, test – links to test  
specs, measurement – links to  
quality specs)

Implementation effort (high, medium, low)

Implementation priority (high, medium, low)

Implementation risk (high, medium, low)

Owner

Author

Spec version

Status (developing, submitted, rejected,  
current, allocated, replaced)

Issues

Comments

Modification dates

Allocation to system version

RD effort

# Input Entity – Res Locator

- ◆ res confirmation #

or

- ◆ flight date

- ◆ departure airport

- ◆ flight #

or destination city

- ◆ frequent flyer #

or passenger name

## F2. Action Contracts

The **meaning** of a function can be defined by the consequences of both valid and invalid *requests for service*.

What conditions are TRUE after the request that were not TRUE before? What conditions characterize the request?

**Action contracts** define the meaning (i.e., consequences) of a function or process using post, pre, during, and constant conditions

# Process Conditions

- ◆ **Constant condition**

A condition that is TRUE at the beginning, during, and after a correct process i.e. its truth value does not change

- ◆ **Pre-condition**

A condition that must or may be TRUE at the beginning of the process, but may become FALSE during the process

- ◆ **Post-condition**

A condition that is TRUE after a correct process, but is FALSE or undefined at the beginning of the process

- ◆ **During condition**

A condition that becomes TRUE during the process, but is FALSE or undefined at the beginning of the process. The condition may have any truth value after the process. [A during condition that is TRUE after the process is a post-condition.]



# Example of Meaning

Consider a table manager TM that inserts entries into a table of bounded capacity. Each entry has an associated key that must be a non-empty string and unique in the table.

**Question:** If TM executes correctly when given an entry  $e$  having a unique key  $e\text{-key}$ , what conditions must be TRUE following execution i.e., what does it mean for TM to execute correctly?

**Answers:**     $\text{Entry}(e\text{-key}) = e$   
                  &  $\text{end count} = \text{start count} + 1$   
                  &  $\text{length } e\text{-key} > 0$   
                  &  $0 \leq \text{count} \leq \text{capacity}$

# Some Conditions

For table manager TM, a **successful insertion** could be described as:

## Pre-conditions

**start count** < **capacity**

## Post-conditions

**Entry (e-key) = e**

& **end count = start count + 1**

## Constant conditions

**length e-key > 0**

&  **$0 \leq \text{count} \leq \text{capacity}$**

# Action Contract -- Example

Inventory Control Functions  
( pre & post conditions for a set of actions)

Order Quantity	On Hand Quantity	On Hand vs. Order	Post-Conditions
Invalid	---		Invalid quantity reported
Valid	Out	[Short]	Backorder created
Valid	In	Short	Backorder created & Partial order ticket created
Valid	In	Enough	Full order ticket created

## F3. Quality Specs

Detail the measurement of quality attributes for both

1. the entire system e.g. **safety** or **performance** and
2. the system functions e.g. **accurately** identify or **easily** create.

Based on Tom Gilb's Planguage specs

# Assessing Quality Attributes

## Identify

1. a **quality attribute**,
2. a **measure** of that attribute,
3. an associated **process** for measurement, and
4. a **method** for interpreting the results such as division of results into ranges to define satisfactory and unsatisfactory outcomes.

# Quality Spec example

ID	QS-1.1
ATTRIBUTE	Learnability – ease of learning to use the system effectively
MEASURE	Time (in minutes) required by novice subjects (with no prior exposure to our website and less than 6 months experience with web applications) to successfully complete a 1-item order (assisted only by the online help system)
METHOD	Time at least 100 novice subjects during user interface testing
MUST	Less than 10 minutes for at least 80% of the novice subjects
GOAL	Less than 7 minutes for at least 80% of the novice subjects
Stretch	Less than 5 minutes for at least 80% of the novice subjects
Past [current system]	11 minutes for 80% of all users ← recent site statistics

# The Hard Part

Identifying measures for ambiguous concepts, for example:

“The system should be fronted by an efficiently navigable, imaginatively designed, attractively laid out and secure web site that ...”

Try to:

1. Answer the question: How will we know when we succeed?
2. Collect examples and counterexamples and find patterns

# Many Patterns of Definition

**Accurately identify potential customers**

(adverb)

(verb)

(adjective)

(noun)

Quality  
Specs

Action  
Contracts

Derived  
Condition

Entity  
Spec



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# Detailing is Powerful

The spec is nothing  
Specing is everything

paraphrasing Eisenhower

## ClearSpecing drives insight

Collaborative detailing causes much greater common understanding than individual authoring and review of natural language text

# References

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